REMARKS

I. Claim Amendment

Claim 1 is amended to recite the temper of the plate during cold bending. This is supported by the disclosure at page 5, paragraph [0022] that prior to shaping the plate is brought to T4 or a T73 or T74 or T76 temper, such as T451 or a T7351 temper, at page 6 that the plate is processed to T451 temper and then bent. Also, the example at page 10 indicates the material is in the T451 temper and then bent.

II. 35 USC §103(a)

Claims 1, 6, 7, 10, 13-16, 18, 19, 23-25, 28, 29, 32 and 35-38 are rejected under 35 USC §103(a) as being unpatentable over AAPA (which the Examiner considers "Applicant's Admitted Prior Art" disclosed by Applicant's specification at pages 1-3) in view of Bruner et al. (US 3,568,491), Liu et al. (US 5,108,520), Chakrabarti et al. (US2002/0150498) and Bryans et al. (US 6,973,815).

A. Claims 1, 6,7,10, 13, 14, 18, 28, 29 and 32

Claim 1 recites bending a workpiece during cold forming and then artificially aging the bent structure. The present invention's artificial ageing after bending is in addition to other ageing that may have occurred before bending.

The Office Action asserts the alleged AAPA discloses a method for producing an integrated monolithic aluminum structure for a part of a wing skin or frame structure for an aircraft wherein an aluminum plate with a thickness in the range of 15 to 75 mm is bent to form a predetermined shaped and, after the bending operation, the plate is machined to produce the monolithic structure. It appears the Office action is pointing to Paragraphs [004] - [009], more specifically the method described at Paragraph [008], of the originally filed specification.

The Office action agrees the AAPA does not disclose heat treating the shaped structure comprising artificially ageing the shaped structure to a T6, T79, T78, T77, T76, T74, T73 or T8 temper prior to machining. Thus, to make up for this deficiency the Office action asserts Bruner et al. The Office action asserts Bruner et al., Col. 4, Lines 28-38, teaches heat treating the shaped structure comprising artificially aging the

shaped structure prior to machining.

As explained during an interview on December 6, 2007, the claims were to be amended (as done by a December 20, 2007 Amendment) to recite: "wherein said cold forming [which occurs before artificial aging] comprises bending to form the shaped structure having a built-in radius." In contrast, Figs. 2-5 of Bruner et al. show the workpiece 10 is not curved by hot forming or cold forming. Bruner et al. requires hot and cold shaping be done by the same die. The die did not bend the part to form a built-in radius. Even if the curved side of Bruner et al. is assumed to be a bend, the curved side is formed before or during hot forming, not by cold forming. Thus, the AAPA/Bruner et al./Liu et al./Chakrabarti et al. rejection was overcome.

Thus, to make up for a deficiency of the previously cited references, the Final Office action asserts it would have been obvious to have cold formed the aeronautical member of AAPA/Bruner et al./Liu et al./Chakrabarti et al., in light of the teachings of Bryans et al. In particular, the Final Office action at page 4 asserts Bryans et al., col. 4, lines 13-17 and 31-33 and col. 6, lines 59-67 and col. 7, lines 1-11, teaches it is known to form aeronautical members by cold forming an alloy plate by bending to form a shaped structure with a built-in radius.

It is respectfully submitted Bryans et al. does not make up for the deficiencies of AAPA/Bruner et al./Liu et al./Chakrabarti et al.

1. <u>Bryans et al. Does not make up for deficiencies of Bruner et al.</u>

Claim 1 recites its cold forming comprises bending to form the shaped structure having a built-in radius. Bruner et al. has a step of forming to final configuration at sub-cooled temperature which the Office action asserts is "cold forming". As acknowledged in the Office action, Bruner et al. does not disclose bending during its cold forming. Thus, the Office action substitutes bending from the cold forming of Bryan et al. for the cold operation of Bruner et al.

It is respectfully submitted this substitution is improper and even if combined the resulting combination does not reach the present invention.

Bruner et al.'s step of forming to final configuration at sub-cooled temperature is not what is known by the term of art "cold-forming." Bruner et al. requires forming at a

temperature substantially below ambient, see col. 2, lines 55-68; claim 1.

In contrast, “cold forming” is commonly carried out at ambient temperature, and the skilled person would not immediately think of sub-zero temperatures (Celsius scale) when discussing cold forming. For example, cold rolling is also a cold forming technique commonly carried out at ambient temperature. Thus, cold forming as disclosed in the present patent application or in Bryans et al. is different from the sub-cooled temperature operation disclosed by Bruner et al.

According to MPEP 2145, it is improper to combine references where the references teach away from their combination. citing *In re Grasselli*, 713 F.2d 731, 743, 218 USPQ 769, 779 (Fed. Cir. 1983) (The claimed catalyst which contained both iron and an alkali metal was not suggested by the combination of a reference which taught the interchangeability of antimony and alkali metal with the same beneficial result, combined with a reference expressly excluding antimony from, and adding iron to, a catalyst.).

Bruner et al teaches away from cold forming a plate at the T4, T73, T74 or T76 temper of present Claim 1, step b. Even if Bruner et al.'s forming to final configuration at sub-cooled temperature was deemed "cold forming" it is not cold forming a plate at the T4, T73, T74 or T76. Thus, Bruner et al.'s forming to final configuration at sub-cooled temperature, even if modified to include the bending of Bryan et al., would not be cold forming a plate at the T4, T73, T74 or T76 temper.

Bruner et al. processes workpieces formed to final configuration at conventional hot-forging temperatures (see col. 1, line 21-22 and claim 1 step (a)). In contrast, the present invention processes a plate product (see Claim 1 step a.) which is a rectangular product which still needs to be brought to final configuration in steps b. and d. Thus, contrary to the statement of the Office action, Bruner et al. does not disclose plate product.

Furthermore, according to Bruner et al., after hot forming, the forged workpiece is solution heat-treated (SHT) and quenched and subsequently brought to a sub-cooled temperature sufficient to both retard natural ageing and to prepare for workpiece in a preferred manner for the subsequent re-forming step (see col. 3, line 54-59). In contrast, the present plate product has been SHT and quenched (analogous to Bruner

et al.), but then stretched and brought to a temper selected from T4, T73, T74, and T76 prior to cold forming. Neither stretching nor the T4 and T7x temper is disclosed by Bruner et al.

By definition according to the Aluminum Association (see paragraph [0015] of the present patent application) the T4 temper provides for products being solution heat-treated and naturally aged to a substantially stable condition, and the T7x temper provides for products being solution heat-treated and then artificially aged.

Thus, where Bruner et al. take measures by cooling to very low temperatures to avoid any aging of the forged product after SHT and quenching prior to forging at sub-cooled temperature, in the present method the ageing (natural or artificial) to T4, T73, T74, and T76 temper are essential features and the plate product is cold formed by bending in these tempers.

2. Bruner et al. is non-analogous

Bruner et al. form the cooled workpiece by forging at the sub-cooled temperature, see claim 1. It is submitted it is relevant that Bruner et al. is “forging”. According to col. 4, line 1-4 this means compressing of the workpiece by a sufficient force that accomplishes complete die closure. Thus, effectively a cold compression is carried out at extremely low temperature. In contrast, the present method carries out, cold forming (at ambient temperature) in the form of bending the plate to form a structure having a built-in radius. Furthermore, the present cold forming is after different forming processes performed at different temperatures as compared to Bruner et al.

3. It is improper to add Bryans et al.'s Bending to Bruner et al.'s method

Replacing Bruner’s sub-cooled temperature forming with the bending of Bryans et al. makes it impossible for Bruner et al. to achieve its required objective of manufacturing a stress-relieved aluminum alloy forging using the same die for both hot forming and cold forming. Thus, the combination is improper because it renders Bruner et al. inoperative for achieving its intended purpose. (See MPEP § 2143.01 (proposed

modification cannot render the prior art unsatisfactory for its intended purpose or change the principle of operation of a reference). Bruner et al. requires manufacturing a stress-relieved aluminum alloy forging using the same die for both forming at hot-forging temperature and forming at sub-cooled temperature (See Bruner et al. Abstract). Both the hot forming and sub-cooled temperature forming shape the forging to its final configuration (see Bruner et al., FIG. 1, Summary of the Invention, as well as col. 3, line 72-col. 4, line 1). There can be no bending during Bruner et al.'s sub-cooled temperature forming to form the shaped structure because the workpiece is in its final configuration prior to sub-cooled temperature forming (Bruner et al., Summary of the Invention).

In the alternative, adding bending of Bryans et al. to the Bruner et al. process as a second cold forming step is illogical because the workpiece is already in its final configuration (Bruner et al., Summary of the Invention, FIG. 1).

Also, the combination of Bruner et al. and Bryans et al. is improper because Bruner et al. relates to forged products being forged to final configuration, whereas Bryans starts from plate products (see for example col. 4, line 33, and col. 6, lines 21-23.). Thus, different product forms are being used in the cited prior art documents.

Furthermore, the present invention solves a problem caused by bending. In particular, the disadvantages of Bryans et al. (as well as the AAPA) result from bending an alloy plate for the manufacturing of aircraft parts. In contrast, Bruner et al. solves a problem caused by forging. Thus, the motivation of Bruner et al. is irrelevant to Bryans et al. and the AAPA.

4. <u>There is no reason to heat treat the bent material of Bryans et al.</u>

Bryans et al. is trying to improve on the prior art process of machining a structure from a piece of raw material, then final machining, and then final forming to achieve the final shape (Bryans et al., col. 1, lines 45-56).

Bryans et al.'s solution is to have a process comprising forming then machining a workpiece to produce a monolithic product (Bryans et al., col. 2, lines 28-30). "Forming prior to machining is a departure from the prior art…." (Bryans et al., col. 3, line 50). For example, Bryans et al. discloses a process of providing a workpiece,

rough machining the workpiece, forming the workpiece, and then fine machining the workpiece. The forming can include bending.

One skilled in the art having Bruner et al. and Bryans et al. would not be motivated to add Bruner et al.'s heat treatment after the cold forming of Bryans et al.

There is no reason to complicate Bryan's process by inserting heat treatment between Bryans et al.'s forming and machining steps. Bryans et al. already has its material in its desired temper and Bryans et al. teaches machining directly after forming. This is seen from Bryans et al., col. 5, lines 3-13.

> In some embodiments, a suitable material for use in the process is a 7000 series aircraft aluminum alloys (*sic*) with a heat treatment of T7451. In some embodiments, the selected material is cold formed, meaning no heat is applied to the material during the process; in some embodiments, the material is formed and processed in a state wherein it was previously heat treated. Further, in the process of the present invention, the selected material need not be subjected to subsequent heat treatments or annealing operations, and the amount of over forming and bending back is may be (*sic*) selected and controlled."

Bryans et al., col. 8, lines 10-17, proposes its own way to manage forming and temper:

> In some embodiments, there will be tensile stress on the outer skin side of the part produced by the process of the present invention, and compressive stresses on the inside integral supporting structure. This may be a result of the forming process and staying within prescribed limits of bend v. plate thickness by alloy and temper (so properties of the selected material are not comprised (*sic, compromised*?)).

5. Liu et al. and Chakrabarti et al.

Liu et al. at page 3 of the Office action was cited for composition of 7xxx-series of aluminum alloys. Chakrabarti et al. at page 4 of the Office action was cited for disclosing properties of various tempers. Neither of these references makes up for the

above-discussed deficiencies of the combination of AAPA and Bruner et al. and Bryans et al.

6. Data shows the present invention method achieves unexpected advantages

The AAPA discloses two methods of prior art processing.

In a first method, the product is bent and stringers or beams are attached as discussed in paragraph [007].

In a second method disclosed in paragraph [007], a plate is heat treated and then bent and then a portion of the heat treated and bent plate is machined away to form stringers and ribs and beams. The second method appears to be the method relied upon by the Office action. As explained by paragraph [009] this bent and machined structure comprising sheet and stringers or beams displays residual or inner stress originating from such bending operation and results in regions with less or more internal stress. Those regions with an elevated level of internal stress tend to be more considerably susceptible to corrosion and fatigue crack propagation. As further explained at page 9, paragraph [0043], "A disadvantage with this approach is that there may be significant residual stress in the product, and this may lead amongst others to increasing the cross-section of frame members or the skin itself to meet required tolerances and safety requirements." As shown in the below-discussed example, the bent plate prior to machining suffers from distortion and residual stress. It is respectfully submitted that, after machining the bent plate to the desired shape, the residual stress remains.

Thus, the product of the first method suffers from distortion. Moreover, the product of the second method initially suffers from distortion and residual stress and, even after machining, suffers from residual stress. In contrast, the presently claimed product simultaneously avoids distortion and residual stress.

The significant reduction in distortion after machining while using the method according to the present claims is illustrated by the Example of the present specification. In particular, data at pages 9 and 10 of the present application shows the unexpected advantages of the present invention by comparing the following:

a product of the present invention, namely a plate in a T451 temper bent to a structure with a 1000 mm radius followed by artificial ageing to a T351 temper; with
a comparative product, namely a plate in the T351 temper bent to a structure with a 1000 mm radius and not further aged.

This comparative product is representative of a product processed according to the second prior art method, but not yet machined. The machining would not remove residual stresses in the metal remaining after machining.

The comparative product is also representative of a product processed according to the first prior art method because the distortion caused by bending a plate would also arise in the first prior art method which includes a plate bending step.
The data at paragraph [0048] shows the comparative example has a longitudinal distortion of 0.15 to 0.22 mm which can be calculated to a residual stress in the longitudinal direction of 49 to 54 MPa. In contrast, the distortion in the product of the present invention has a longitudinal distortion of 0.07 to 0.09 mm which can be calculated to a residual stress in the longitudinal direction of 16 to 22 MPa. This is unexpectedly lower.

The presently claimed method involves two distinct heat treatments, one heat treatment carried out prior to shaping, the shaping includes bending, and a second heat treatment (ageing) after shaping. The integrated monolithic aluminum structure is machined from the shaped structure. By ageing after the shaping, it is possible to obtain essentially distortion-free structural members suitable for, e.g., aircraft fuselage and wing applications. Another advantage of the method and the product of the present invention is that it provides a thinner final monolithic product or structure that has strength and weight advantages over thicker type products produced over conventional methods. This means that designs with thinner walls and less weight may be provided and approved for use. Yet another advantage of the method and the product of the present invention is the weight reduction of the monolithic part. Weight is further reduced also by the possible elimination of fasteners. This is related to the accuracy advantages in the machining operation resulting from the reduced distortion, and the inherent accuracy of final machining after forming.

B. Claims 15-16

Applicants submit the method disclosed by AAPA/Bruner et al./Liu et al./Chakrabarti et al. would not bring distortion to the claimed values. Moreover as explained above data shows the unexpected advantages of the present invention.

The Office action does not respond to the data.

C. Claims 19 and 23-25

Applicants submit the method disclosed by AAPA/Bruner et al./Liu et al./Chakrabarti et al. would not achieve the claimed values. Moreover as explained above data shows the unexpected advantages of the present invention.

The Office action does not respond to the data.

D. Claims 35-37

Claims 35-37 further distinguish over the references. Bruner, col. 3, lines 43-45 mentions "aircraft structural forging" and col. 4, last paragraph before the claims, mentions aircraft-quality stress relieved forgings. However, Brunner et al. is silent with regard to the structural parts of an aircraft such as fuselage.

Claim 35 recites the method of manufacturing structural parts of an aircraft.

Claim 36 recites the structural parts comprise stringers and skin, wherein the stringers are connected to the skin. As mentioned above, the aeronautical parts having bent structures and especially aircraft parts having skin and stringers connected thereto have to comply with more stringent requirements than most manufacturing parts in other areas.

Claim 37 recites machining the shaped structure obtains an integrated monolithic aluminum structure for part of a wing skin or a frame portion for an aircraft

E. Claim 38

Claim 38 further distinguishes over the references by being further commensurate in scope with the data.

III. Conclusion

In view of the above it is respectfully submitted that all objections and rejections are overcome. Thus, a Notice of Allowance is respectfully requested.

Respectfully submitted,

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